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ABSTRACT

There is substantial evidence that prose-relevant pictures contribute to increased recall of prose materials, particularly if the subjects are young children. The purpose of this study was to investigate the contribution of prose-relevant pictures to immediate and delayed recall of written prose including science content when the subjects were older learners. Subjects were 42 undergraduate students with limited background in the sciences who were assigned to one of two instructional treatments, prose-plus-pictures or prose-only. A 12-item multiple-choice test was administered immediately on completion of the reading, and the same subjects were retested 28 days later using the same test. The delayed test was unannounced, and students did not reread the material prior to this test. Although the prose-plus-picture group's mean test score was significantly higher than that of the prose-only group in the immediate testing condition, both groups scored significantly lower on the delayed test, and the differences between the scores of the two groups on this test were not significant. The pictures used and a table showing the analysis of test scores are appended, and 22 references are listed. (MES)

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Prose-Relevant Pictures and Recall From Science Text

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Running head: PICTURES AND RECALL FROM SCIENCE TEXT

Summary.-- The effects of prose-relevant pictures on 42 college students' prose recall were studied. Students were given one of two instructional treatments (prose-plus-pictures, prose-only) which included science content. An immediate- and delayed-recall criterion measure was administered. The prose-plus-picture group's mean criterion test score was significantly greater than that of the prose-only group in the immediate testing condition.

During recent years, many junior and senior high school, and college textbooks have presented large numbers of illustrations and pictures with the written text materials (Individualized Science Instructional System, 1980; Intermediate Science Curriculum Study [ISCS], 1973; Intermediate Science Curriculum Study, 1973, 1970; Wong, Bernstein, & Shevick, 1978). In some cases, as much page space is devoted to pictures as is to the written text.

Many science curriculum materials stress active investigative behavior on the part of students, problem-oriented activities, individualization of instruction, and the development of the inquiry processes of science (Intermediate Science Curriculum Study, 1972). While one may agree that process-oriented goals should be major outcomes of science instruction, it is still desirable and necessary for students to remember information. Gagne and Briggs (1974) suggested that:

> Students of science learn much verbal information, just as they do in other fields of study. They learn the properties of materials, objects, living things, for example. A large number of "science facts" may not constitute a defensible primary goal of science instruction. Nevertheless, the learning of such "facts" is an essential part of the learning of science. Without information, learning in any subject could have no continuity, no "substance" (p. 53).

It can be argued that one must recall observations or information to develop concepts and ideas of science. In addition, it may be necessary to understand factors influencing the recall of information prior to developing a full understanding of factors influencing the development of higher level cognitive outcomes.

Early investigations on the use of pictures as adjuncts to written prose materials by Vernon (1953) and Burdick (1960) using instructional treatments including science content, supported the conclusion by Samuels (1970) that "there was almost unanimous agreement that pictures, when used as adjuncts to the printed text, do not facilitate comprehension" (p. 405). In a review of pictorial research related to science education, Holliday (1973) concluded that:

> pictures in conjunction with related verbal material can facilitate recall of a combination of verbal and pictorial information. It is suspected that pictures can increase comprehension in some cases; however more empirical evidence is needed (p. 210).

There is now substantial support for the claim that prose-relevant pictures do contribute to increased recall of prose materials, particularly if the subjects are young children. (Holliday, 1975; Holliday & Harvey 1976; Holliday & Thursby, 1977; Levie & Lentz, 1982; Levin, 1981; Levin, Anglin & Carney, in press; Levin & Lesgold, 1978; Willows, Borwick, & Hayvren, 1981). Levie and Lentz (1982) conclude that "illustrations facilitate learning the information in written text that is depicted in illustration" (p. 231). Levie and Lentz found that the average improvement for groups reading with pictures was 36%. Holliday's (1973) call for more empirical studies remains valid, particularly if studies include instructional treatments from existing science textbooks and subjects are science students.

The purpose of this study was to investigate the contribution of prose-relevant pictures to immediate- and delayed-recall of written prose which included science content, when the audience included older learners (college undergraduates).

Method

Subjects

Subjects were 42 students enrolled in one of two sections of an undergraduate graduate science teaching methods course for elementary education majors. Most of the subjects were juniors and seniors and a majority were female. The students had limited backgrounds in the sciences. The content presented in the treatment has not been previously discussed in the methods course. Students participating in the study had previously passed basic competency examinations in reading, writing, and mathematics. To pass these examinations, a student was required to score at or above the level of the average high school senior on each of the tests.

Materials

Instructional treatments were adapted from "Speed in Less Than 1 Second" (ISCS, 1970). The prose passage discussed how to make and use a water clock to measure small time intervals. The passage also described how to use the water clock to study velocity and acceleration. The primary alteration of the material consisted of eliminating the laboratory component of the activity and removing the pictures for the prose-only treatment. While the investigators are interested in the active involvement of the learner in science classes, this study examined the possible contribution of pictures to the recall of information in written prose materials. The prose-passage informed students how to do the tasks but did not require them to perform the investigation. A sample of the written prose follows:

> First, let's get a "feel" for how the water clock works. Water is poured into the funnel-shaped clock. If the clock is held vertically, drops of water come out of the clock. When a wet square of paper is placed on top of the water clock, the paper keeps the water from dripping.

The pictures that accompanied the sample prose passage are displayed in Fig. 1. Slight modifications in the ISCS (1970) text and pictures were made to add clarity.

Insert Figure 1 about here.

Subjects in the experimental group had 12 pages of reading material, including one paragraph on each page. The paragraph was located on the left side of the page. The right side of each page contained one to three prose-relevant pictures. All pictures were line drawings and represented the narrative being presented. Students in the control group read the exact same written prose passage without pictures.

A 12-item multiple choice test was developed to test for recall of information presented in the prose passage and represented in the pictures. Significant picture effects have

been found with various test formats (Levie & Lentz, 1982). A sample item from the criterion measure follows:

Which of the following happens when you pour water into an uncovered water clock?

A. the water drops fall at regular intervals
B. a stream of water flows through the clock
C. the water pushes the cart along a plane
D. the water is held in the clock
E. the water rusts the water clock

Design and Procedure

Students were randomly assigned one of two instructional treatments (prose-plus-pictures, prose-only). There were 22 subjects in the prose-plus-picture and 20 in the prose-only condition. They were asked to take designated seats in one of two areas in the classroom. The same information was presented on each student's cover sheet and instructions were given orally to the students. Students were instructed to read the selected material and review the accompanying pictures (prose-plus-picture group) one time and to raise their hands upon completion of the reading. All students completed the treatment within a 15-min time period.

A 12-item multiple-choice test was immediately administered to all subjects. Twenty-eight days later the same subjects were retested using the same criterion-test. The delayed test was unannounced and administered using the same instructions used for the immediate test. The subjects did not re-read the prose passages prior to the delayed test.

Results

The experimental group (prose-plus-pictures) average criterion test score (82%) was significantly greater than that of the control subjects (70%) in the immediate condition ($t_{40} = 2.08$, $p < .05$). The criterion measure discrimination index was 0.41. The Kuder-Richardson Index was 0.67 and the standard error of measurement was 1.37.

Insert Table 1 about here.

After a 4-wk. delay, the experimental group's average criterion test score (62%) did not differ significantly from that of control subjects (57%), $t < 100$. Both groups (prose-plus-pictures, prose-only) scored significantly lower on the delayed test than on the immediate test. The prose-plus-picture groups average recall was significantly lower in the delayed testing condition, (paired $t_{21} = 7.50$, $p < .001$). Prose-only subjects also recalled significantly less in the delayed testing condition, (paired $t_{20} = 3.59$, $p < .01$).

Discussion

The inclusion of representational pictures with written prose materials resulted in significantly higher average recall for the prose-plus-picture group in the immediate testing condition. The magnitude of the picture effects in the immediate testing condition are similar to those identified in previous studies using other types of prose passages, i.e., fictional narratives and human interest stories (Anglin, in press; Levin & Berry, 1980; Peng & Levin, 1979). Subjects' average recall in the prose-plus-picture condition was 12% higher than for the prose-only group. Levin (1981) has argued that representational pictures produce a stronger memory trace than the trace associated with a verbal representation of the text.

The picture effects were not durable over time (28 days). This finding is not consistent with results from previous studies using other types of prose passages (Anglin, in press; Levie & Lentz, 1982; Levin & Berry, 1980; Peng & Levin, 1979). The lack of picture effects in the delayed testing condition may be due to: (a) passage type and/or (b) the type of test items used in the multiple choice criterion instrument.

The durability of picture effects may vary across passage types. Fictional narratives or human interest stories may be more memorable than the type of prose passage used in the current study. The type of criterion-test items used may also have contributed to the lack of picture effects in the delayed testing condition.

Anderson (1972) recommends the use of paraphrased questions to infer comprehension. Replicating this study using paraphrased questions would be informative. However, as previously discussed in this paper, significant picture effects have been found with various test formats. Further study examining the effect of type of passage and the test questions used in the criterion measure are worth pursuing.

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Fig. 1. Pictures accompanying sample prose passage in experimental condition

Table 1

Comparison of Experimental and Control Groups on Immediate and Delayed Tests

	Group					
	Experimental (n=22)		Control (n=20)			
Test	Mean	S.D.	Mean	S.D.	Independent t-value	Prob.
Immediate	9.86	1.98	8.40	2.56	2.08*	0.044
Delayed	7.40	2.20	6.85	2.41	0.79	0.436

*$p < 0.05$